

Debris Removal inside a Fuel Assembly - FAST

Background

Globally, Westinghouse leads the nuclear industry in leak-free fuel reliability. We have worked hard to achieve this through robust fuel designs and a fuel reliability improvement process that we developed and implemented to drive continuous improvement in fuel hardware reliability. While safety is always the foremost priority, the financial impact of fuel failures has become increasingly relevant to utilities seeking ways to reduce nuclear plant operating costs.

Fuel failure due to fretting by debris occurs in all types of reactors and is one of the major failure mechanisms in Boiling Water Reactors. This occurs when metallic debris is trapped in the fuel assemblies, and leads to fretting and penetration of the cladding wall of a fuel rod. The debris is usually introduced into the reactor's coolant system through various ways – such as repair, maintenance operations, construction or even continuous operation. Therefore, a sufficient way for avoiding fuel failures is to clean, identify and eliminate debris sources.

Description

The Fuel Assembly Suction Tool (FAST) is a cleaning device used primarily for removing debris from the inside of a fuel assembly.

The FAST suction hood is positioned on top of a fuel assembly with the fuel handling machine. The operation can be performed in a fuel pool as well as in the core and takes six to eight minutes per fuel assembly, including positioning time.

Debris of different varieties that are captured inside the fuel assembly between the spacers can be removed with the FAST equipment, which works with an intermittent water flow through the fuel. Debris particles are collected in the filter

house that has a changeable stainless steel filter of 80 μm . Smaller particles, such as crud, are channeled through the pump to an external filter.

Removing metallic debris from fuel assemblies will reduce the risk of a fuel failure. It also is important to identify debris sources to prevent the particles from entering into the reactor core in the future. FAST makes it possible to capture debris due to its filter system. The debris in the internal metallic filter can be transferred to another sample holder for visual inspection and characterization (X-ray fluorescence spectroscopy). The results can be a basis for a root cause analysis to investigate the source of the debris.



Operation of FAST Equipment in a German Nuclear Power Plant – including 4 floating tanks for weight reduction

Benefits

- Removes debris from fuel assemblies, reducing the risk of fuel failures and costs for unplanned outages and fuel repair.
- Collected particles can be analyzed and their origin can be determined. Debris sources can be eliminated!
- Loose crud that might spread out to other systems can be removed from the fuel and collected in a filter. This can lower dose levels for personnel.

Experience

The FAST process and equipment were developed in 2007-08 in cooperation with a Swedish Nuclear Power Plant in Sweden, to reduce fuel failures due to debris fretting.

Since then, it has been successfully used in different countries, and applied to several fuel types from various vendors in fuel pools as well in the reactor core.



FAST Equipment is lowered into Spent Fuel Pool



FAST Equipment from below

For More Information

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